Yanbu Industrial College

Department of Electrical Power Engineering Technology

EEET 103 Electrical Machines I

Lab Exercise No. 12

Title **STARTING AND OPERATING CHARACTERISTICS OF SPLIT PHASE MOTOR UNDER NO LOAD**

Student Name: _____ **Student ID:** _____

Submission Date: _____ **Lab Section:** _____

Important Notes

1. Every student must write Name, Section, and Lab exercise No, Title, ID Number and Submission Date clearly in provided space.
2. Only neat, clean and hand written reports on this prescribed format given in E-learning will be accepted.
3. Students are encouraged to work and study together as team work is highly recommended.
4. No credit will be given for works that are copied from any source.
5. Assignments and reports must be turned in on time.
6. Please make photocopy of your lab report before submission as original may not be returned to you.
7. In case of late submission 20% of total credits will be reduced per day.

For Instructor's use only.	
Date Received	
Maximum Marks	**10**
Late By	**days**
Deductions	**%**
Marks Obtained	
Comments (If any)	

Signature: _____

STARTING AND OPERATING CHARACTERISTICS OF SPLIT PHASE MOTOR UNDER NO LOAD

PERFORMANCE OBJECTIVES:

Upon completion of this laboratory experiment, the student will be able to:

- Understand the performance of the split-phase induction motor under no load.

EQUIPMENT:

1. MFM-100 Multi-Function Motor.
2. 0-140 volt Hampden variable AC power supply.
3. Two Hampden AC Voltmeters.
4. Two Hampden AC Ammeters.
5. Tachometer.

DISCUSSION:

The most widely used types of the single-phase motors are split-phase motors. These are preferred where ever motors of 1/20 to 1/3 horse power are required. This type of motor also has a spatially offset auxiliary winding (starter winding) that develops a phase-shifted current linkage to enable initial start-up. The effects of overlapping alternating fields, produced by the main and auxiliary windings, correspond to a rotary field. The necessary phase shift for currents in the two windings can be achieved with resistors, inductors or capacitors, whereby resistors or capacitors are generally preferred.

Single-phase induction motors exhibit shunt characteristic. If the auxiliary winding's phase shift is achieved through the use of capacitance, one refers to this as a capacitor motor. Another capacitor can be switched in parallel to the motor's so-called "running capacitor" to increase starting torque. This is referred to as a "starting capacitor" and it must switch out of the circuit after the motor has come up to speed, otherwise the auxiliary winding would be destroyed by high current. This capacitor is switched out of the circuit by a current relay or by a centrifugal switch.

The single phase motor with resistive phase shift is also called a bifilar-wound motor. The no load current is usually 60% to 80 % of the full load current, which is high compared to three-phase motors. Most of the no-load current is used to produce the magnetic field in the motor, and only a small portion is used to overcome mechanical friction and the copper and the iron losses. Because of the large magnetizing current, the power factor of these motors is rarely more than 60 %, even at full load. Split-phase motors tend to be much noisier than their three-phase counterparts, because of the inherent 120 cycles mechanical vibration. This vibration can be reduced by using resilient rubber mounting support.

CAUTION!

1. **High voltages are present in this experiment. Do not make any connections with the power on. The power should be turned off after completing measurement**

CIRCUIT CONNECTIONS:

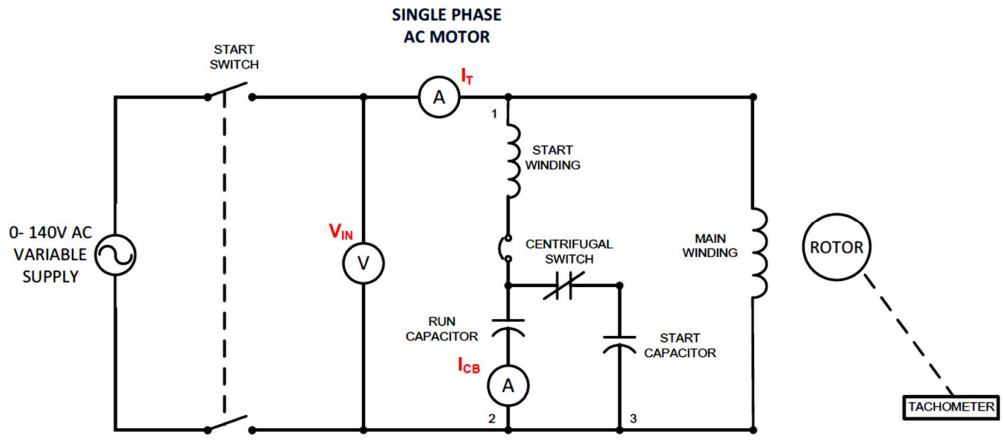


Figure 1.1

PROCEDURE:

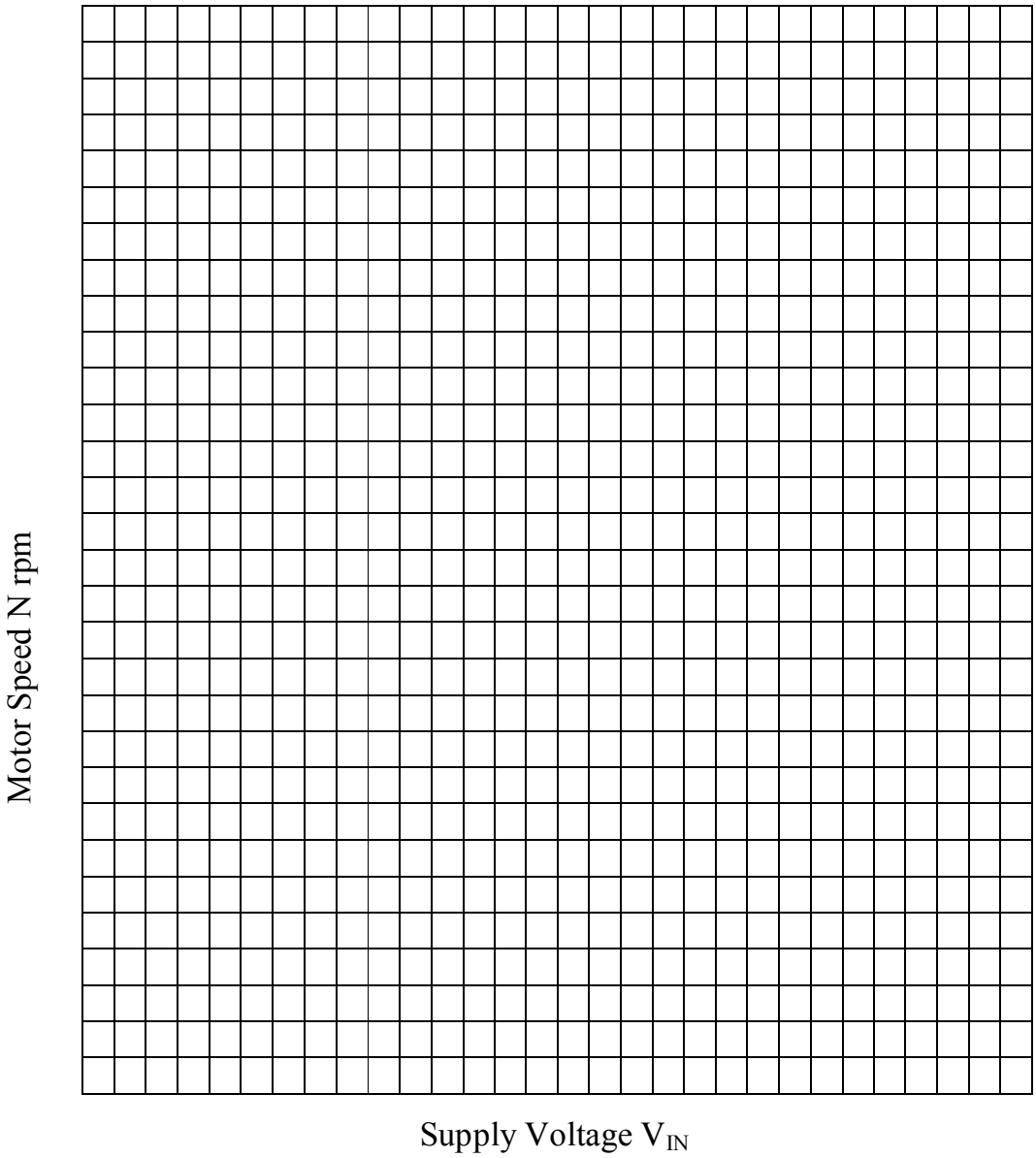
1. Connect the circuit of single phase capacitor start capacitor run motor given in Figure 1.1
2. After the teacher has checked and approved the circuit, put the circuit into operation.
3. Turn the knob of the 140-volt supply to zero.
4. Turn on the main ac circuit-breaker switch, turn on the 140-volt AC supply circuit-breaker switch and turn on the motor circuit-breaker switch.
5. Slowly increase the output of the 0-140V AC supply until the voltmeter reads the rated motor voltage (V =115 volt AC). The motor should be running now.
6. Measure all the values V_{IN}, I_T, I_{CB} and N rpm for 115 volt and record in the observation table.
7. Repeat Steps 6 given values of $V_{IN,}$ take readings and record in the observation table.
8. Return the voltage of the variable AC power supply to zero and turn off the AC power supply.
9. Turn off the power supply units. Disconnect all leads.

OBSERVATIONS:

Supply Voltage V_{IN}	**115 V**	**100 V**	**90 V**	**80 V**	**70 V**	**60 V**	**50 V**	**40 V**	**30 V**
Total Current I_T									
Starting Winding Current I_{CB}									
Motor Speed N rpm									

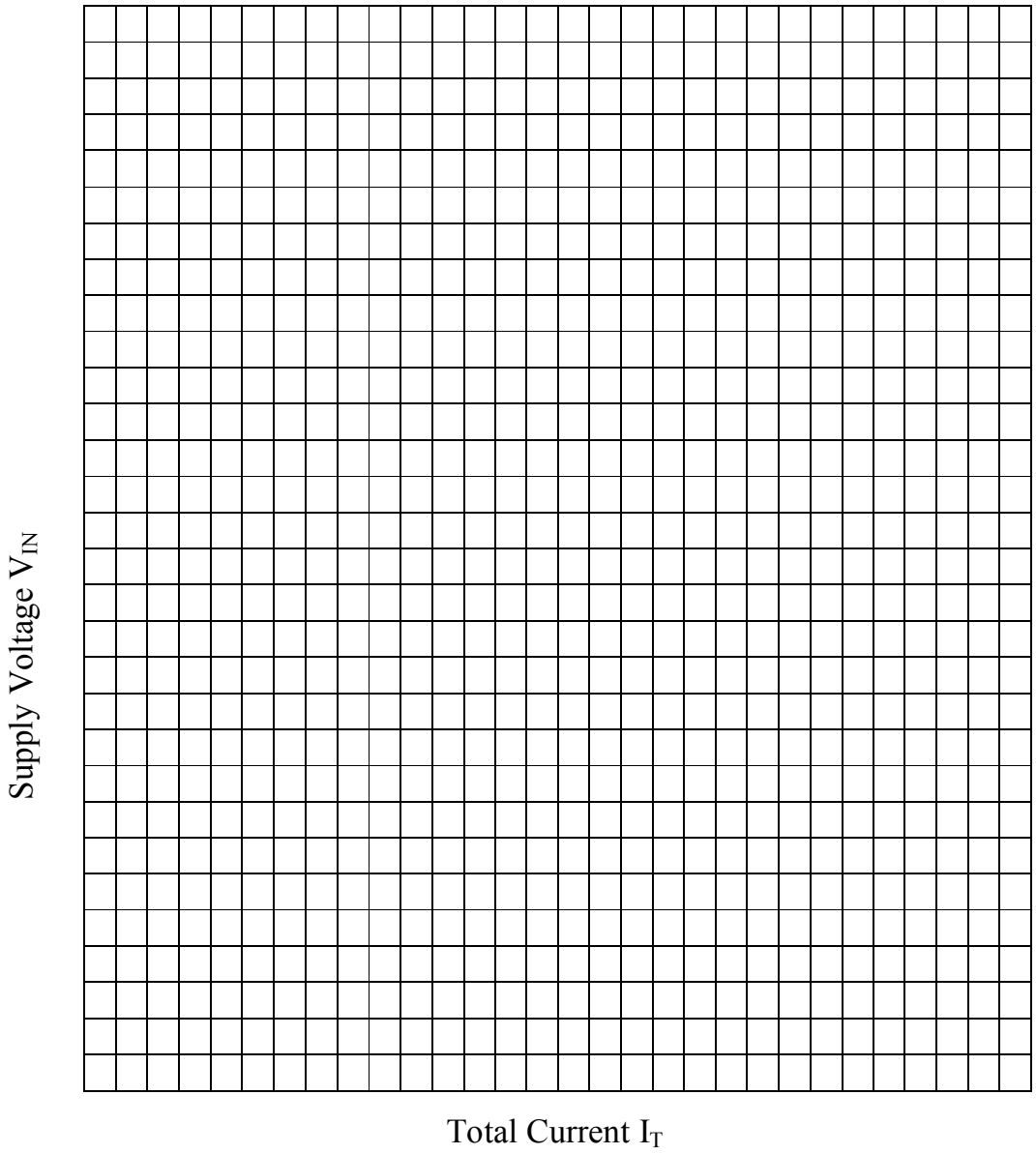
GRAPH 01:

Plot the Characteristics curve between **N** and $\mathbf{V_{IN}}$ as Split phase motor under no-load



GRAPH 02:

Plot the Characteristics curve between Supply Voltage $\mathbf{V_{IN}}$ and Current $\mathbf{I_T}$ as Split phase motor under no-load



REPORT

Prepare a report containing:

1. Diagrams of each circuit.
2. All tables.
3. Graph on a grid paper.
4. All calculations and required data.
5. Answers to questions.

REVIEW QUESTIONS

1. A single-winding single-phase induction motor has:

☐	a	Low starting torque.
☐	b	Zero starting torque.
☐	c	High starting torque.
☐	d	Starting torque equal to full load torque.

2. In a split- phase motor, the starting winding:

☐	a	Has greater inductance than the main winding.
☐	b	Has less inductance than the main winding.
☐	c	Is identical to the main winding.

3. The direction of rotation of a single phase motor is:

☐	a	From the main pole to the adjacent auxiliary pole having the same magnetic polarity.
☐	b	From the auxiliary pole to the adjacent main pole having the same magnetic polarity.
☐	c	Either direction It is impossible to predict.

4. To reverse the direction of rotation of a single phase induction motor:

☐	a	Interchange incoming power supply terminals.
☐	b	Interchange the connections to main winding only.
☐	c	Interchange the connections to auxiliary winding only
☐	d	Either interchanges the connections to main winding or to auxiliary winding.

5. A single-phase induction motor needs:

☐	a	An auxiliary winding to start.
☐	b	An auxiliary winding to run.
☐	c	An auxiliary winding for both starting and running.

6. An induction motor must run

☐	a	At synchronous speed.
☐	b	Faster than synchronous speed.
☐	c	Slower than synchronous speed.

7. On a split-phase motor, the opening of the centrifugal switch:

	a	Cuts out the main winding
	b	Cuts out the starting winding.
	c	Cuts out the start capacitor.

8. On the two value capacitor motor, the opening of the centrifugal switch:

	a	Cuts out the main winding
	b	Cuts out the starting winding.
	c	Cuts out the start capacitor.

9. The speed at which an AC induction motor stator field rotates is referred to as its _____ speed.

10. When the split-phase induction motor has reached approximately 75% of its rated speed, a _____ operated switch disconnects the starting winding from the supply.

11. The starting torque of a resistance split-phase induction motor is _____ the starting torque of a capacitor start-induction motor.

FINAL CHECKLIST

All the students must make sure, before they leave the Lab:

1. Turn the value of variable power supplies and resistive load to zero
2. Main power switch on the work bench is put "OFF".
3. All the connection of machines/ equipment is removed.
4. All machines/meters are properly placed (slide in) either in storage cabinet or in work station itself.
5. All connecting leads are sorted out according to their length and colours and placed on the hooks provided in the side of the work station.
6. Submit your answers to the questions, together with your data, calculations (if any) and results before the next laboratory sessions.